

CLAIMS

1. A method of cooling a stack (12) formed by stacking a plurality of unit power generation cells (18), said unit
5 power generation cells (18) each including an electrolyte electrode assembly (28) and a first separator (34) and a second separator (36) sandwiching said electrolyte electrode assembly (28), said electrolyte electrode assembly (28) including an anode electrode (22), a cathode electrode (24),
10 and a solid polymer electrolyte (26) interposed between said anode electrode (22) and said cathode electrode (24), the method comprising the steps of:

cooling said stack (12) by immersing said stack (12) in an electrically insulating liquid coolant inside a stack
15 container case (14); and

condensing, by a condenser (16), the liquid coolant (108) which has been vaporized at said stack container case (14) by cooling said stack (12), and returning the condensed liquid coolant (108) to said stack container case (14).

2. A method according to claim 1, wherein the liquid coolant (108) is boiled into vapor in the nucleate boiling state.

25 3. A method according to claim 2, wherein a liquid having a boiling temperature lower than an operating temperature of said stack (12) by 10°C to 25°C is used as

the liquid coolant (108).

4. A method according to claim 2, wherein a lower alcohol or a solvent of fluorine compound is used as the liquid coolant (108).

5. A method according to any one of claims 1 to 4, wherein the liquid coolant (108) is supplied into said stack (12).

6. A polymer electrolyte fuel cell (10) including a stack (12) formed by stacking a plurality of unit power generation cells (18), said unit power generation cells (18) each including an electrolyte electrode assembly (28) and a first separator (34) and a second separator (36) sandwiching said electrolyte electrode assembly (28), said electrolyte electrode assembly (28) including an anode electrode (22), a cathode electrode (24), and a solid polymer electrolyte (26) interposed between said anode electrode (22) and said cathode electrode (24), said polymer electrolyte fuel cell (10) further comprising:

a stack container case (14) containing said stack (12); and

a condenser (16) provided in said stack container case (14),

wherein said stack (12) is immersed in an electrically insulating liquid coolant (108) inside said stack container

case (14) to cool said stack (12); and

said condenser (16) condenses the liquid coolant (108) which has been vaporized at said stack container case (14) by cooling said stack (12).

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7. A polymer electrolyte fuel cell (10) according to claim 6, wherein coating is applied to at least one of a surface of said condenser (16) and an inner surface of said stack container case (14).

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8. A polymer electrolyte fuel cell (10) according to claim 7, wherein the coating comprises fluorine resin.

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9. A polymer electrolyte fuel cell (10) according to claim 8, wherein the coating comprises polytetrafluoroethylene.

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10. A polymer electrolyte fuel cell (10) according to any one of claims 6 to 9, wherein said stack (12) includes a cooling plate (20) having at least one groove (42, 44) for supplying the liquid coolant (108) into said stack (12).

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11. A polymer electrolyte fuel cell (10) according to any one of claims 6 to 10, wherein a plurality of protrusions (88) protruding toward said stack (12) are provided on an inner surface of said stack container case (14), and said protrusions (88) are exposed from the liquid

surface of the liquid coolant (108).

12. A polymer electrolyte fuel cell (10) according to
any one of claims 6 to 11, further comprising a trapping
5 section (118) for trapping the condensed liquid coolant
(108) at said condenser (16), and a circulation mechanism
for allowing the liquid coolant (108) to flow from said
trapping section (118) back to said stack container case
(14).